WHITE PAPER

10 Common Misconceptions Regarding the Mechanical Integrity of Your Industrial Assets

Author: Dr. Feth-Allah Setta

The purpose of this abstract is to review some of the misconceptions that commonly distort our judgment on the integrity status of plant assets. One of the objectives of this article is to raise awareness and support the implementation of an efficient mechanical integrity (MI) program within your organization. This will help to facilitate optimal management of inspections and maintenance - and enhance the efficiency of the anomaly management within your facilities.

1. MI would not need to be verified as part of the process safety risk assessment

MI constitutes an entire chapter of process safety management (PSM), as defined by the Center of Chemical Process Safety (CCPS). Nevertheless, this matter is often taken for granted. In reality, the mechanical integrity of each of the components of your asset (pipework system, pressure vessels, tanks, safety valves, supports, bolting, etc) must be verified periodically during their lifetime to prevent loss of containment. As a consequence, a process safety assessment carried out without previous validation of the component/loop/equipment/asset mechanical integrity may be totally misleading with regard to the real risk.

2. It would not be necessary to implement a mechanical integrity program before the occurrence of the first leaks

Addressing a problem once we detect its consequences is not a reasonable solution – and especially not in process safety, where a single event can be catastrophic. Indeed, it is necessary to implement a **mechanical integrity and corrosion management program** covering the essential elements from the commissioning phase. This will enable a better management of your asset and enhance its chances to be considered for a safe life extension. Efficient screening and prescriptive tools, in addition of robust procedures, will enable the criticality ranking of an anomaly from the first inspections and will help prioritize the anomaly mitigation plan for a suitable response.

3. It would be necessary to inspect the entire plant

A sophisticated approach based on the risk-based inspection (RBI) methodology will enable an inspection rationalization in order to target efforts on the most susceptible locations. This methodology, developed in the United States and actively used in the UK and Middle-East, revealed to be particularly effective in the deployment of the inspection teams where and when required.

4. Corrosion issues would be totally unpredictable

Corrosion mechanisms, whether it is internal and/or external, are predictable in terms of kinetics and locations - if the relevant information is available and processed. Indeed, depending on the degradation mechanism, a predictive calculation will give an estimation of the material wall loss in millimeter per year. This will enable the inclusion of reasonable scenarios with regards to the evolution of your equipments' integrity, and to optimize the prescriptive and corrective actions.

5. Insulation would always be a sufficient barrier to prevent external corrosion

Corrosion under insulation (CUI) is often difficult to anticipate without appropriate preparation. This type of degradation is an integral part of the **DEKRA process safety and mechanical integrity program**. Indeed, this type of corrosion needs to be taken into account from the initial stages in order to anticipate the most susceptible locations as well as the potential consequences. The evaporation-condensation cycle patterns as well as the insulation type need to be considered from the conception phase. This is even more important given that the necessary inspections will often require the insulation to be stripped-off and reinstated, which can be costly and time-consuming.

6. There is no alternative to equipment replacement following a loss of containment

Several repair methods exist and are used to limit the duration of production shutdowns. Those methods often enable a safe and controlled delay of the equipment replacement. Those repairs may consist of, for instance, the installation of resin (or polymeric) layers or the fitting of mechanical clamps. The lifespan of such repairs can be calculated on a case by case basis and will generally be between two to five years. This type of device requires a specific kind of monitoring and maintenance program but can be very handy with regards to their efficiency and implementation speed.

7. The basis of design of your installation would be robust enough to compensate for any operating condition change

This assertion constitutes a recurrent mistake. Indeed, the basic concepts used during the conception phase (FEED) postulate that the internal/external environment, as well as the nature and type of process will remain the same during the whole design life. However, it is more and more frequent that changes, even minor in the process, become necessary. This will have an impact on the aging kinetics that would need to be taken into account and incorporated within the mechanical integrity programme. Thus, such changes should be dealt with in a smooth and controlled manner with minimum impact to the equipment integrity.

8. A confined space would be protected from the external environment

This is an assumption often made. Yet, this is usually wrong. Indeed, equipment is regularly installed under deluge systems which are generally tested at a specific frequency. It involves a potential water ingress and creation of an active corrosion cell. Such threats are also taken into account within the mechanical integrity program and recommendations.

9. Brand new external coating would be proof of integrity

One of the recurrent example is the corrosion occurrence on the external surface of pipework within hollow trunnions. Indeed, weep holes are drilled during their installation and are, for most of them, left open and leaving an opening to water ingress. Corrosion is then occurring not only on the trunnion's wall, which will

weaken its strength and functionality, but also in the external pipework face. Pipework loss of containment can then occur because of potential internal corrosion and/or the combination of external corrosion within the trunnion. Those phenomena are investigated as part of the inspection plan dictated by the mechanical integrity program to prevent any loss of containment.

10. Inspectors could not assess the fitness for service of critical elements

DEKRA's mechanical integrity programs include matrices with anomaly acceptability thresholds and criteria of non-conformity. Thus, criticality levels can be defined for remaining wall thicknesses, for bolting volume losses, for mechanical damage, etc. Those matrices are built up on a case-by-case basis and will enable the inspectors to enhance the quality of their input within their reports.

DR. FETH-ALLAH SETTA

Dr. Feth-Allah Setta is a corrosion and mechanical integrity engineer with over nine years experience in the chemical and petrochemical industries. He holds a PhD in mechanical engineering on a subject combining knowledge in materials, corrosion and the mechanical integrity management of pressure systems.

In recent years, he has been able to put his experience to work for many international companies (such as BG, BP, Shell, Chevron, Perenco, IONA, CNR, Kinsale energy, Chrysaor...) active in the North Sea and confronted to the advanced aging of their assets.

Would you like to get more information?

Contact Us

DEKRA Process Safety

The breadth and depth of expertise in process safety makes us globally recognized specialists and trusted advisors. We help our clients to understand and evaluate their risks, and work together to develop pragmatic solutions. Our value-adding and practical approach integrates specialist process safety management, engineering and testing. We seek to educate and grow client competence to provide sustainable performance improvement. Partnering with our clients we combine technical expertise with a passion for life preservation, harm reduction and asset protection. As a part of the world's leading expert organization DEKRA, we are the global partner for a safe world.

Process Safety Management (PSM) Programs

- Design and creation of relevant PSM programs
- Support the implementation, monitoring, and sustainability of PSM programs
- Audit existing PSM programs, comparing with best practices around the world
- Correct and improve deficient programs

Process Safety Information/Data (Laboratory Testing)

- Flammability/combustibility properties of dusts, gases, vapors, mists, and hybrid atmospheres
- Chemical reaction hazards and chemical process optimization (reaction and adiabatic calorimetry RC1, ARC, VSP, Dewar)
- Thermal instability (DSC, DTA, and powder specific tests)
- Energetic materials, explosives, propellants, pyrotechnics to DOT, UN, etc. protocols
- Regulatory testing: REACH, UN, CLP, ADR, OSHA, DOT
- Electrostatic testing for powders, liquids, process equipment, liners, shoes, FIBCs

Specialist Consulting (Technical/Engineering)

- Dust, gas, and vapor flash fire and explosion hazards
- Electrostatic hazards, problems, and applications
- Reactive chemical, self-heating, and thermal instability hazards
- Hazardous area classification
- Mechanical equipment ignition risk assessment
- Transport & classification of dangerous goods

We have offices throughout North America, Europe, and Asia.
For more information, visit **www.dekra-process-safety.com**
To contact us: **process-safety-usa@dekra.com**

DEKRA